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# **16 Multi-Plate Pipe**

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**Plates**

**Bolts**

**Plate Identification and Location**

**Pipe-Arch Assembly**

**Bolting**

# CHAPTER SIXTEEN:

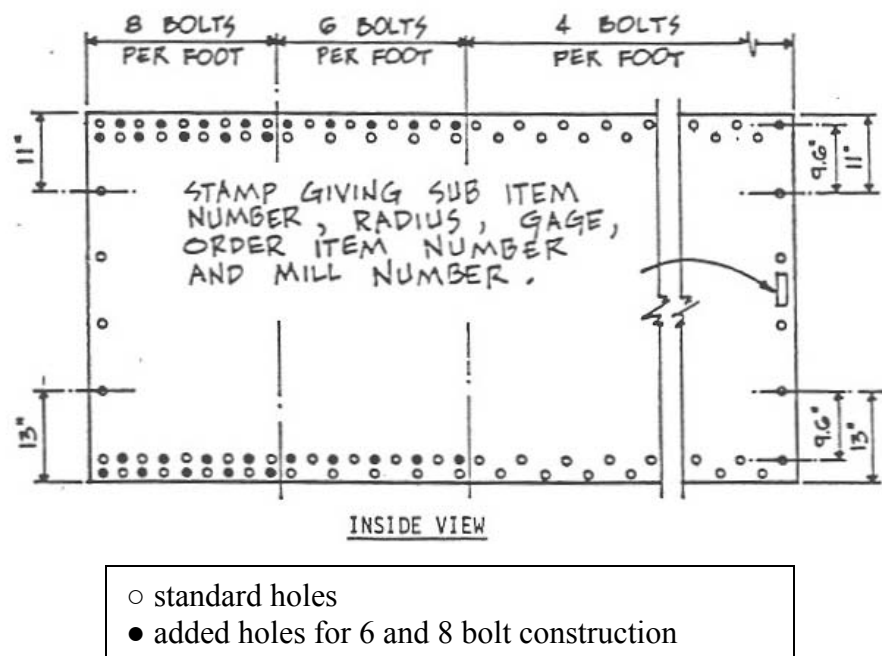
## MULTI-PLATE PIPE

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### PLATES

The plates for Multi-Plate pipe are furnished in two lengths, nominally 10 feet and 12 feet long. In special instances, one or more 6-foot long plates may be furnished. Plate widths are approximately 3 feet, 4 feet, 5 feet, 6 feet, and 7 feet wide. The 3-foot wide plate has 4 holes across each end, the 4 foot has 6 holes, the 5 foot has 7 holes, the 6 foot has 8 holes, and the 7 foot plate has 9 holes.

Each plate is identified by numbers stamped into the inside crest of an end corrugation near the middle of the plate, except plates for special ends have these numbers stamped near each corner before cutting. The first three numbers are the sub item number. The second three numbers are the plate radius in inches. The seventh number is the plate gage number, with the exception that 0 is for 10 gage plate, 2 is for 12 gage plate, and a blank designates a thickness greater than 1 gage. The eighth number is the order item number. The last four numbers are the mill order number. (Figure 16-1).



**Figure 16-1. Pipe Plate**

If the structure is to be erected with skewed or sloped ends, the embossed identification marks should be on the inside of each cut plate. Plates to be used in an elbow section are identified with similar embossed numbers on the inside of each cut and welded plate. These numbers correspond to plates marked on the cut end or elbow layout drawing.

## **BOLTS**

For convenience, Multi-Plate bolt and nut containers are stenciled as follows:

$\frac{3}{4}$  in. x 1-1/4 in.  
 $\frac{3}{4}$  in. x 1-1/2 in.  
 $\frac{3}{4}$  in. x 1-3/4 in.  
 $\frac{3}{4}$  in. x 2 ft  
 $\frac{3}{4}$  in. x 3 ft  
 Nuts

Each structure has six 3-inch long service bolts that are used as assembly tools to temporarily draw the plates together where needed. These bolts should not remain in the structure. The required number of bolts for a structure rarely amounts to full keg lots or all sizes. The carton containing partial amounts of one size also have the required 3-inch bolts. This carton is marked accordingly.

Bolts are furnished in two lengths. The longer length is used for three thicknesses of metal. The length of bolts furnished for the various plate thickness requirements is as follows:

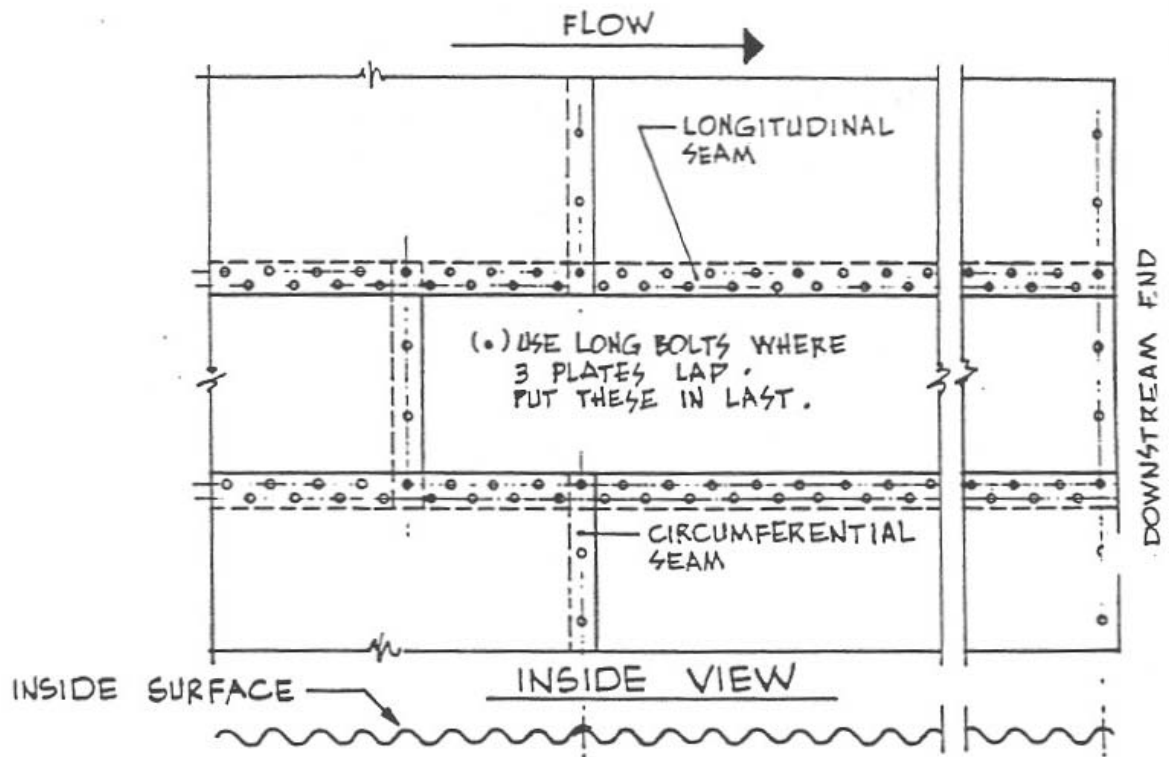
### GALVANIZED PLATES

<u>Plate Gage</u>	<u>Thickness</u>	<u>Bolt Lengths</u>
1 Gage	280 in.	1-1/2 ft and 2 in.
3 Gage	249 in.	1-1/2 ft and 2 in.
5 Gage	218 in.	1-1/2 ft and 1-3/4 in.
7 Gage	188 in.	1-1/2 ft and 1-3/4 in.
8 Gage	168 in.	1-1/4 ft and 1-1/2 in.
10 Gage	138 in.	1-1/4 ft and 1-1/2 in.
12 Gage	109 in.	1-1/4 ft and 1-1/2 in.

## ASPHALT COATED PLATES

<u>Plate Gage</u>	<u>Thickness</u>	<u>Bolt Lengths</u>
1 Gage	280 in.	1-3/4 ft and 2 in.
3 Gage	249 in.	1-3/4 ft and 2 in.
5 Gage	218 in.	1-3/4 ft and 2 in.
7 Gage	188 in.	1-3/4 ft and 2 in.
8 Gage	168 in.	1-1/2 ft and 1-3/4 in.
10 Gage	138 in.	1-1/2 ft and 1-3/4 in.
12 Gage	109 in.	1-1/2 ft and 1-3/4 in.

The longer of the two bolt lengths is placed in the corners of the plates where three thicknesses of metal overlap and in the hole next to the corner in the longitudinal seam. The shorter of the two bolts is placed where only two thicknesses of metal overlap (Figure 16-2).



**Figure 16-2. Bolt Placement**

## **PLATE IDENTIFICATION and LOCATION**

The various widths of plates are located in the barrel in accordance with the plate layout drawings. The numbers appearing in the barrel area or on the plates are the number of bolt holes across the end of each plate. The line layout and/or plate layout shows total 10-foot and 12-foot-long rings making up the structure.

The beginning and ending rings are shown in Figure 16-3 for square end structures and these structures contain combinations of 10-foot and 12-foot rings required to obtain the proper plate stagger. Special plates in cut end structures are shown on the plate layout together with the necessary 10-foot and 12-foot long plates required to obtain the proper seam stagger in the barrel. Intermediate barrel rings contain plates which are all the same length. For cut plates and elbow cut and welded plates, the numbers appear on the plate layout corresponding to the embossed numbers on the plates themselves.

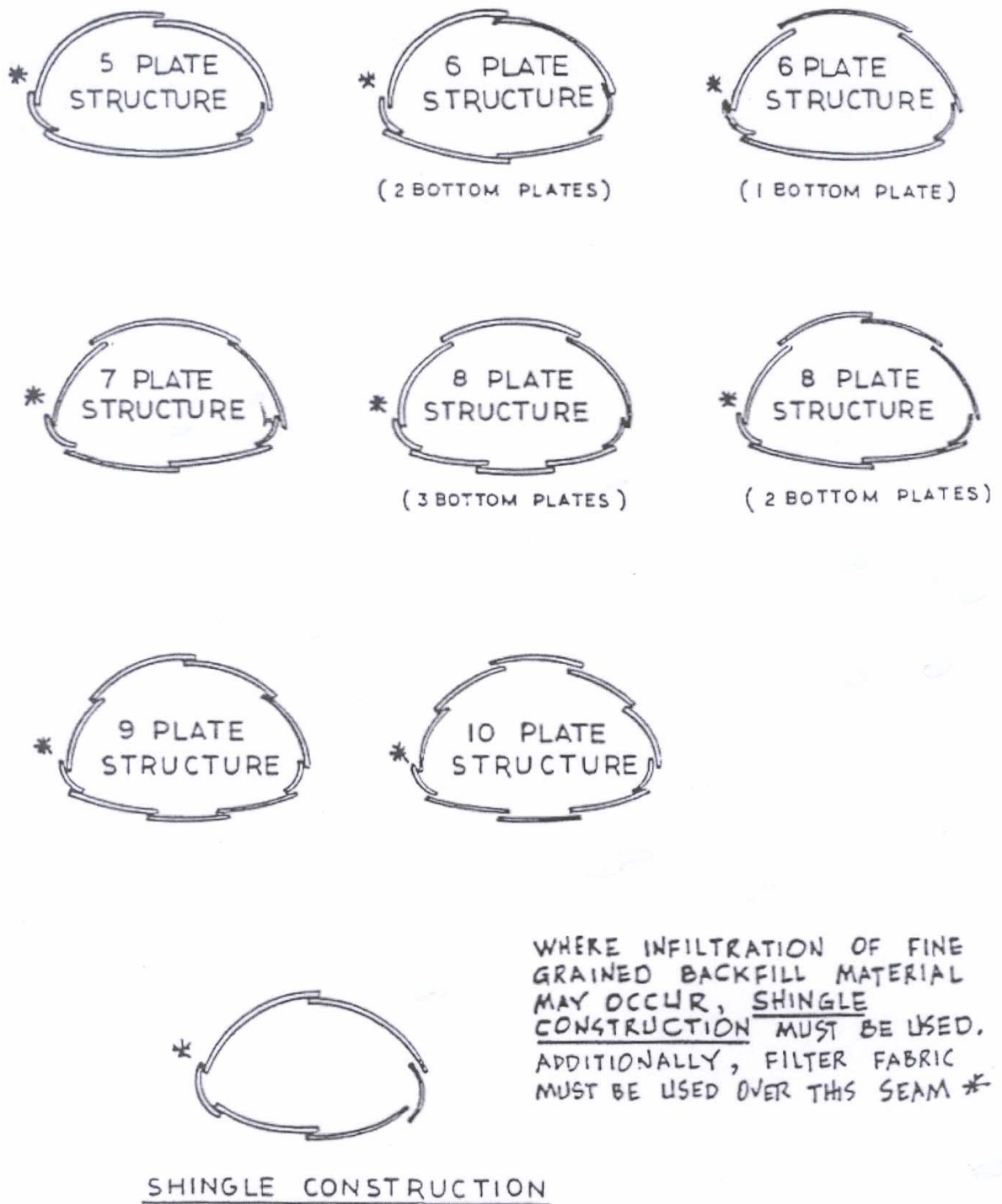


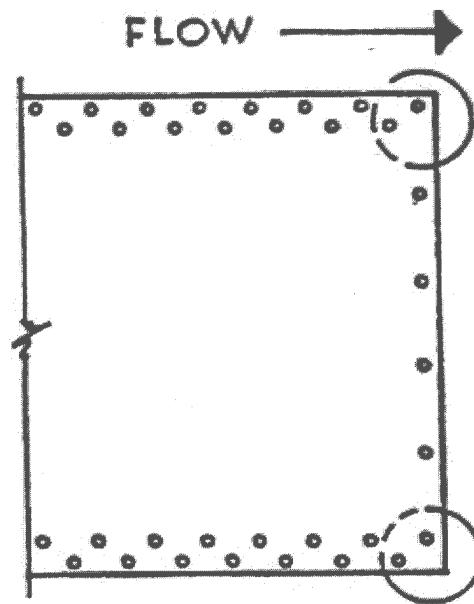
Figure 16-3. Typical Barrel End Views (looking downstream)

## PIPE-ARCH ASSEMBLY

The pipe-arch is assembled in three stages as follows:

- 1) bottom
- 2) corners
- 3) top

The bottom (invert) plates are assembled by laying the first bottom plate at the outlet end, then placing each succeeding plate in the longitudinal row so the plate laps one corrugation of the preceding plate (Figure 16-2). The invert plates are positioned accurately with a stringline before tightening the bolts.

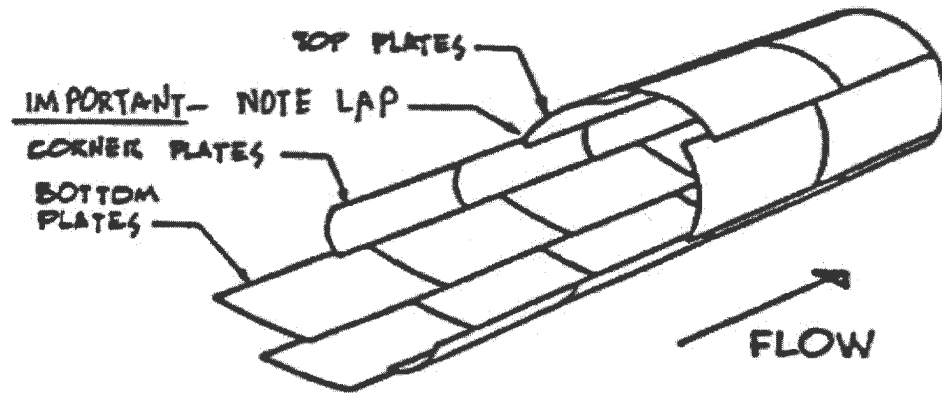


The two corner bolt holes (Figure 16-4) are different. One bolt is close to the plate edge and the other bolt is set in from the plate edge. When beginning construction, the corner bolt hole pattern is required to match the pattern shown on the plate layout drawing.

**Figure 17-4. Inside View of Pipe**

After several invert plates have been laid down, aligned, and bolts tightened, the corner plates should be attached to each side at the outlet end. The corner plate may lap either inside or outside the invert plates (Figure 16-4). Also, each additional corner plate is required to lap over the preceding plate by one corrugation.

Finally, the top plates are put in place. The upper half of the pipe-arch is assembled with each plate lapping outside the plate immediately below, except at the top corner plate (Figures 16-2 and 16-5). Each row is extended only far enough to support the next row of plates above to a place where one final plate may be added to complete the ring. Each additional top plate laps over the previous plate by one corrugation.



**Figure 16-5. Plate Assembly**

## **BOLTING**

To facilitate alignment, the initial assembly should be done with a minimum number of bolts. Sufficient bolts are inserted in each seam to hold the plates in position; however, the nuts are not tightened, thus leaving the plate free to move slightly to help in matching the remaining bolt holes. Bolting the circumferential seam is best done by first placing the bolts near the middle of the plate. About three rings behind the plate assembly, the remaining bolts are inserted using pins or a pry bar to align the holes. After all bolts are in place, the nuts are tightened. Aligning of bolt holes is done easier when the bolts are loose while drifting of holes is best done with adjacent bolts tight.

Sometimes, tightening all of the bottom plate bolts as the bottom is assembled is desirable. If this procedure is done, certain plates are required to be properly aligned before tightening the bolts. Corner and top plates should always be assembled with as few bolts as possible while initially assembling the structure.

The recommended range for bolt torque is between 100 and 300 foot-pounds. A balanced progression of tightening should be maintained with respect to the axis of the structure, to prevent a spiraling tendency.